JOURNAL

OF THE

New York Entomological Society.

Vol. XI. JUNE, 1903. No. 2.

COCCIDÆ OF THE CONIFERÆ, WITH THE DESCRIPTIONS OF TEN NEW SPECIES FROM CALIFORNIA.

By George A. Coleman.

Stanford University, California.

This paper includes the descriptions of ten new species of Coccidæ and a list of additional species, all found on conifers in California, a host list showing the distribution of these various coniferous species in the state with the Coccidæ found on each, some brief notes on the economic status of these conifer-infesting Coccidæ, and a complete list of all other records of Coccidæ on coniferous hosts in the world. The collections of, and notes on, the Coccidæ of the California conifers were mostly made in the summer of 1901, during a special trip for the purpose, extending for about one thousand miles through the forests of the northern California coast region. The journey was made on foot with the camp equipment borne on pack animals, so that trails through the heart of the forests and back and forth over the mountain crests could be made. The trip extended through the most important timber region of the state, including parts, or all, of the range of twenty-five species of conifers.

I wish to express my thanks to Professors W. R. Dudley and V. L. Kellogg, of Stanford University, for placing funds at my disposal for the expenses of the trip; to Mr. T. H. Pergande, for comparison of some of my specimens with those in the collection of the Division of Entomology, U. S. Dept. of Agric.; to Mr. Edw. M. Ehrhorn

for material collected by him and for helpful suggestions, and to Mr. T. D. A. Cockerell for kindly reviewing my MS. and specimens, as well as for valuable notes included, with their source indicated, in this paper.

This paper was prepared in the Entomological Laboratory of Stanford University, under the direction of Professor V. L. Kellogg.

Phenacoccus kuwanæ, sp. nov.

Female and Ovisac.—Length about 2.5 mm.; ovisac yellowish-white, short oblong, smooth.

Adult Female.—Length 1.6 mm., width .9 mm.; color yellowish-white; body sparsely covered with a yellowish-white powder; slightly hairy; a great many minute short spines scattered evenly over each segment; a single gland orifice on the lateral margin of each segment; last segment with lateral, marginal groups of several rather long, slender spines, near the base of which are grouped several large gland orifices; just beneath this group there arises a very long hair, with a shorter one on either side near its base. Anal ring with six long, stout hairs. Legs (Plate V, Fig. 1) rather long and slender; tarsus (65 μ) about one half as long as tibia (30 μ), well armed with long slender hairs; claw long (7 μ), slightly curved, with a distinct notch; two stout digitules on ventral side of claw; I have been able to see but one digitule on the tarsus, but presume they are both there. Antennæ (Plate V, Fig. 2), length .7 mm.; nine-segmented, formula, 9, (2, 3,) 5, 8, (1, 6, 7,) 4; measurements, 1 (12), 2 (22), 3 (20), 4 (10), 5 (13), 6 (12), 7 (12), 8 (13), 9 (25). Each segment with several long, slender hairs as indicated in the figure.

Eggs.— Very light yellow.

Habitat. — Discovered by the author on a species of lichen growing on the weeping spruce, *Picea breweriana,* on the east side, near the summit of the Salmon Mountains, about ten miles west of Salmon Forks, Siskiyou Co., California, August 3, 1901. Only a few specimens were found.

Named for Mr. S. I. Kuwana, of Stanford University.

Type specimen in the entomological collection of Stanford University.

Dactylopius andersoni, sp. nov.

Female with Ovisac. — Length about 6 mm.; ovisac white, oblong, very convex, transversely convoluted and longitudinally bisected by a dorso-median groove.

Adult Female. — Length 3.3 mm., width 1.6 mm.; color lead-gray, covered with heavy white powder; marginal appendages short; caudal filaments short and stout. Body sparingly covered with rather long and stout hairs; a few minute gland openings scattered over the surface, with one larger one on each lateral margin, of each segment; last two abdominal segments armed with marginal groups of two stout spines; last segment with a long stout hair arising just laterad of each group of spines. Anal ring with six long, stout hairs. Legs (Plate V, Fig. 3) short and

stout, not reaching beyond the margin of the body; tarsus one third as long as the tibia; claw stout; the four digitules present, ventral pair very stout; tibia and tarsus armed with numerous long hairs; a single short spine on the inner margin of tibia near the distal end. Antennæ (Plate V. Fig. 4), about .5 mm. in length, eight-segmented, formula, 8, 3, 2, 1, 5, 4 (6, 7); each segment with numerous hairs.

Habitat. — Discovered by the author on *Cupressus goveniana*, in the southern part of Lake Co., California, June 21, 1901. Found by Mr. M. P. Anderson and the author, on *Libocedrus decurrens*, in Scott Valley, Siskiyou Co., Cal., in August, 1901.

In both localities mentioned the trees on which the specimens were found were in well-protected, warm little nooks, in the first instance in a little ravine about half way down the mountain side, in the second, just at the edge of the valley and at the foot of a dry hill.

Note. — Mr. Edward M. Ehrhorn and the author made a careful comparison of specimens of this species with specimens of *D. ryani* in his collection. While we find some resemblance, there are also many marked differences, viz., the ovisac of *D. ryani* is a rather shapeless fluffy mass, while that of *D. andersoni* is perfectly symmetrical and of a very solid construction. There is much difference in the size of the two species and in the antennæ, as will be seen by the following table:

D. andersoni, antennæ, 1 (22), 2 (26), 3 (27), 4 (16), 5 (20), 6 (15), 7 (15), 8 (35).

D. ryani, antennæ, 1 (15), 2 (17), 3 (22), 4 (17), 5 (12), 6 (13), 7 (12), 8 (30).

Type specimens in the entomological collection of Stanford University.

Dactylopius dudleyi, sp. nov.

Adult Female and Ovisac. — The adult female is usually entirely enclosed in a very light, fluffy, white ovisac, in which the eggs are embedded at the upper anterior part, some of the sacs being so loosely constructed that both eggs and female are visible from above. As they are of a very irregular shape, it is very hard to give any exact measurement, but they are on an average, about 2.5 mm. in length.

Adult Female (Plate V, Fig. 5).— The adult female is about 1.6 mm. in length and .6 mm. in width; color grayish-white; body covered with fine whitish powder; marginal appendages not conspicuous, caudal filaments short. Body covered with many fine hairs, which are scattered evenly over each segment, each segment densely pitted with the openings of fine spinning glands, one or two larger ones near the margin; all segments with marginal groups of two or three small spines, eighth abdominal segment with one long hair and several shorter ones on each lateral margin, arising from near the groups of spines, ninth segment armed with marginal groups of

two stout spines; anal ring with six long hairs; legs (Plate V, Fig. 6) very stout, tarsus less than half as long as the tibia, well armed with spines and hairs as indicated in the figure; claw stout, strongly curved, the four digitules present. Antennæ (Plate V, Fig. 7) eight-segmented (some specimens show a tendency of the eighth segment to divide, see Fig. 7), length .36 mm.; formula, 8 (32), 1 (20), 2 (18), 3 (16), 5 (13), 7 (12), 4 (11), 6 (10).

Larva (Plate V, Fig. 8). — The newly hatched larvæ are of a transparent whitish color and about .9 mm. in length; antennæ seven-segmented, formula, 7, 3, 1, 2 (4, 6), 5. Legs about the same as in the adult female, except more slender; body hairs, spinning glands, spines, etc., as in the adult.

The Egg.— The eggs are rounded oval, dark yellow and about .3 mm. in length.

Male.— Not known as yet.

Habitat.— In April, 1901, a few specimens of this species were discovered by the author, on some herbarium specimens of *Cupressus macnabiana*, which were collected by Professor W. R. Dudley, of Stanford University, near Clear Creek, four and one half miles west of Shasta P. O., Shasta Co., Cal., July 19, 1899. As *Cupressus macnabiana* is a very rare cypress, being known but from three or four localities in the state, I paid a visit to the locality above mentioned, Aug. 29, 1901, and found the adult, with young insects very abundant.

The trees on which this coccid are found are situated at an elevation of about one thousand feet in a little flat, in a dry, sandy, chalky soil, and consists of about a dozen small trees, not more than ten feet in height. Several of these trees were literally covered with the insects and none was free from them. This is the only locality from which they have been obtained.

Named for Professor W. R. Dudley, of Stanford University.

NOTE.— *D. ryani* Coq., also found on cypress in California is not the same, it having the last antennal joint 99 μ; penultimate joint 47 μ. It is also larger and differently colored. (Ckll.)

Type specimens in the entomological collection of Stanford University.

Aspidiotus californicus, sp. nov.

Scale of Female. — Length about 2 mm., width about 1 mm.; oblong-oval and rather conical in form; color blackish with pale edges; exuviæ central, reddish-brown. (An examination of hundreds of specimens shows a great variation in form and size; where crowded together on the tree they are small and more nearly circular in outline, but where only a few are on the tree they are larger and more oblong in shape.)

Adult Female. — Length about .9 mm., width about .65 mm.; egg-shaped; color light greenish-yellow; eyes rather large; antennæ reduced to a single large, flat, circu-

lar, basal segment bearing a single long heavy spine; body bearing several rows of long slender hairs. Characters of abdominal margin as follows (Plate V, Fig. 9): there are four pairs of lobes; the median pair are well developed, of medium size, rounded, with a slight lateral notch; second pair not so long as the median, rounded, but with outer corner truncate; third pair inconspicuous, broad, triangular and with terminal margin serrate; fourth pair of the same general shape as the third pair but broader and less conspicuous, terminal margin also serrate; a single broad plate between median lobes, with four or five points; two rather broad plates, with deeply incised margins, between median and second lobes; three broad plates, with deeply incised margins, between second and third lobes; a broad plate with slightly serrated margin, followed by two rather narrow plates with deeply incised margins, between third and fourth lobes; a large dorsal and ventral spine at the base of each lobe. There are five groups of spinnerets; the anterior group consisting of three to five, cephalo-laterals of about eight, caudo-laterals of two to five. (I have examined over a hundred specimens from different localities and on different hosts, and find a considerable variation in the number and grouping of the spinnerets, but the above arrangement seems to obtain in the majority of cases; however, where the anterior laterals consist of three or less, the caudo-laterals correspond.)

Scale of Male. — Smaller, darker colored and with exuviæ nearer one end than in the female.

Adult Male. — I have found the adult male in mounting dried specimens but they were not good enough for description.

Larva. — The newly born larvæ are about .3 mm. in length and about .2 mm. in width; suboval in shape, narrowing anteriorly; color bright yellow; eyes inconspicuous; antennæ very long, five-segmented, formula, 5, 2, 1, 3, 4, segment five much longer than all the others together, ringed and with several stout hairs; legs rather long and stout, femur stout, tibia less than half the length of the tarsus, claw long and slender and slightly curved, digitules of tarsus and claw, long and slender; on the last abdominal segment there is a median pair of lobes which are quite conspicuous; between these lobes there are two large tubercles bearing terminal hairs; other lobes, plates and hairs are not well defined.

Habitat and Distribution. — Discovered by the author on *Pinus sabiniana*, San Felipe Hills, Mt. Hamilton range, alt. 2,700 feet. June 4, 1901. Cobb Mt., Lake Co. June 22, 1901. Supply Creek, Hoopa Valley Indian Reservation, July, 1901 and Scott Valley, Mt. Shasta, and the upper Sacramento region on *Pinus ponderosa*. On *Pinus lambertiana* (herbarium specimens), Santa Lucia Peak, and Sugar Pine Flat, Sierra Nevada Mts. Elevation 7,000 ft.

On *Pinus attenuata*, mts. west of Scott Valley, Siskiyou Co., and S. E. side of Mt. Shasta, Aug., 1901. On *P. ponderosa* (herbarium specimens), Zyanta Creek, Santa Cruz Co.

Type specimen in the entomological collection of Stanford University.

Aspidiotus florenciæ, sp. nov.

Scale of Female. — Length about 3 mm., width 1 mm., of rectangular shape with rounded corners, nearly semi-cylindrical; color light slaty blue, paler at the ends; exuviæ bright red, usually situated near one end, but sometimes in the middle.

Adult Female.— Length about 1.4 mm., width about .9 mm.; a remarkably large and elongated body; antenna reduced to a large conical tubercle, with a long heavy spine at the base on the inside and a short tubercle on the outside; body with several long hairs on and near the lateral margin of each segment, a group of several on the cephalic margin between the antennæ, a few short hairs scattered over the body. Characters of the abdominal margin as follows (Plate V, Fig. 10): two pairs of lobes; median pair large rounded, without notches (compare with *A. californicus* in the figure); second pair small, of about the same shape as the median; a pair of gland openings between the median lobes, and a number of others as indicated in the figure; a pair of long serrated plates between first and second lobes; a large, broad, serrated plate laterad of second lobes; a dorsal and ventral spine arising at the outer base of the second lobes, and three more pairs on the lateral margins as indicated in the figure. Four groups of spinnerets, right hand cephalo-laterals composed of about seven, left hand cephalo-laterals of three; right hand caudo-laterals of three, left hand caudo-laterals of about six or seven (I have examined a number of specimens and this rather queer arrangement is the same in all of them).

Larva. — The newly born larvæ are about .2 mm. long and .1 mm. wide; antennæ five-segmented, formula, 5, 2, 1, 3, 4, segment five much longer than all the others together, transversely ringed, with two long lateral hairs; legs rather long and stout, claw sleuder, slightly curved, digitules present; last abdominal segment with two large lobes between which are two short spines and two very long hairs.

Habitat.— Discovered by the author on herbarium specimens of *Pinus ponderosa*, Pine Ridge, California.

Named for my wife.

NOTE.—"These two species (*A. californicus* and *A. florenciæ*), are very close to one another and to *A. abietes* (Schr.) (Syns. *pini* Comst., and *abietes* Comst.). They are extremely variable as to the lobes (*californicus* I see may have two or three pairs) and glands, and it strikes me as possible that the two species are extreme variations of the one, and that is *abietes*. However, I can hardly believe this, especially as the dorsal glands are less numerous in *californicus* than in *florenciæ*. It is *californicus* which is nearest to *abietes;* it probably is a 'representative species,' taking the place of *abietes* in California.

"*A. florenciæ* has some resemblance to *A. cupressi* Ckll. but *cupressi* has only one pair of lobes and the anal orifice is much nearer the hind end than in *florenciæ*. (*Cupressi* lives in Mexico, see Biol. Cent. America.)" (Cockerell.)

Type specimen in the entomological collection of Stanford University.

Aspidiotus coniferarum *Ckll.* var. **shastæ**, var. nov.

Scale of Female. — The outer scale is a thin, transparent, brownish-white cone, about 1 mm. in diameter, with a minute yellowish exuvia at the apex; beneath this shell there is a thick, opaque, reddish-brown skin, enclosing the insect; there is a very thin white ventral scale. The outer scale bears such a close resemblance to the little drops of exuded gum with which the host trees, *Cupressus Macnabiana*, are covered, that it is a very hard matter to distinguish them in the live state, but they fall from the dried branches by the hundred.

Adult Female (Plate VI, Fig. 11). — Length .5 mm., width .4 mm.; body nearly circular in outline; color light brown; a very few minute hairs visible; spines on the margin as indicated in the figure; spiracles with club-shaped protuberances; antennæ reduced to stout spines with tubercular base. Characters of abdominal margin as follows (Plate VI, Fig. 12): a single pair of lobes, which are inconspicuous, broadly rounded, often apparently fused; there is a gland opening between these lobes, with a serrated plate surrounding it, often protruding beyond the lobes (see Fig. 12); a gland opens also, just at the lateral margin of either lobe, where a slight conical plate is sometimes visible; a second and third slight incision, into which glands also open, are situated above the lobes; spines as follows: a very small pair between the median lobes; five pairs of stouter ones are situated at intervals along the margin. No groups of spinnerets.

Larva (Plate VI, Fig. 13). — The young, which are developed in the body of the female, are, at birth, about .2 mm. in length, oblong-oval in form, and of a light lemon-yellow color; margins of thoracic segments marked by pairs of spines; lobes and spines of abdominal segment showing very distinctly; legs rather long and slender; tarsus about three times as long as tibia; with two very long digitules on the dorsal side and a stout spine on the ventral side near the distal end; claw long and slender, slightly curved, with digitules slightly knobbed. Antennæ five-jointed, formula, 5, 1, 2 (3, 4), the fifth is slightly longer than all of the other segments together, with numerous transverse folds and several long hairs; the first segment bears one long hair.

Scale of Male. — I have found small, dark-colored scales along with the female, which I believe to be the male, but not having found the adult insect or the pupa I cannot describe it as such.

Habitat. — Discovered by the author, on *Cupressus macnabiana*, at Clear Creek, near Shasta P. O., Shasta Co., Cal., Aug. 29, 1901, on the same trees with *Dactylopius dudleyi*, where it was also very abundant.

In going over my material in the laboratory, I find specimens which have the same general characters as the above species except that they average much larger, from *Cupressus goveniana*, collected in the southern part of Lake Co., Cal., June 21, 1901. I believe them to be the same species and will so record them until further investigation.

NOTE. — Prof. T. D. A. Cockerell has kindly compared this species with his *A. coniferarum* and also sent me a slide of his species. After carefully comparing them, and reading his description in Psyche, I find the following marked differences: my species is much smaller and the single pair of lobes are narrower and shorter than in *A. coniferarum*. I am unable to find in my specimens the second and third pair of lobes which are described for the above species, and as they are also from different hosts, I propose it as a variety.

Type specimens in the entomological collection of Stanford University.

Aspidiotus (subg. **Diaspidiotus**) **ehrhorni**, sp. nov.

Scale of Female. — Nearly circular, very slightly convex; dark gray, with light yellow exuviæ at apex; diameter about 2 mm.; covered with minute granules and resembling the lichens under which it is found. Underneath this outer scale is a dark reddish-brown skin enclosing the insect; ventral scale very thin, transparent and white.

Adult Female. — Length .9 mm., width .7 mm.; color light yellow; outline of body subovate. Characters of abdominal margin as follows (Plate VI, Fig. 14): there are five groups of spinnerets, anterior group of two, anterior-laterals of five to nine, posterior-laterals of three to seven; a single pair of large lobes, each rounded, with slight lateral notch on the outer side; between the lobes there is a gland orifice, with a slightly serrated margin; just laterad of each lobe there is a large incision into which a gland opens, and around the margin of which are two or three conical and sometimes serrated plates; a second large incision and gland orifice, with one or two small conical plates, a short distance from the first incision; a third very slight incision, about an equal distance laterad of this second one; spines as follows: a dorsal and ventral pair of short, stout ones just laterad of each lobe, a pair of longer ones between the first and second incision, a pair of about the same size, between second and third incision, a pair of smaller ones at some distance above these.

Scale of Male. — The scale of the male is oblong, about 1 mm. in length; dark gray, with bright red exuviæ at one end.

Very near to *A. ancylus* Putnam, but smaller and with a smaller number of spines on the abdominal margin, also with an additional incision.

Habitat. — Discovered by Mr. Edward M. Ehrhorn, concealed among and underneath the lichens on the bark of *Abies concolor*, near Sissons, Mt. Shasta, Siskiyou Co., Cal., Sept. 4, 1901. Also on the bark of *Libocedrus decurrens* at the same locality.

Type specimen in the entomological collection of Stanford University.

Leucaspis kelloggi, sp. nov.

Scale of Female (Plate VI, Fig. 15). — Length 3 mm (larval skin .4 mm., second skin .6 mm., scale 2 mm.); width 1 mm., straight, very convex about the

middle, gradually flattening out posteriorly; color of larval skin lemon yellow, first and second skins light brown with translucent edges; ventral scale formed by a turning in of the lateral edges of the 2d scale, sometimes completely enclosing the insect.

Adult Female (Plate VI, Fig. 16). — The color of the female is transparent, yellowish-white, abdominal segments yellowish; length about 1 mm., width .4 mm.; elongate oval, head flattened anteriorly, thorax cylindrical, with flattened and very conspicuous marginal lobes. Abdominal margin flattened, and with the following characters (Plate VI, Fig. 16, *a*). There are no groups of spinnerets, but a large spinning gland opens into each incision and there are several near each lateral margin of the caudal segment, as there are also several on the lateral margin of each body segment; the median lobes are well developed, rounded, with a slight lateral notch, the second pair are double, about equally developed, of about the same shape as the median, but smaller, the third pair are also double, but the outer ones are smaller than the inner ones, of the same shape and appearance as the second pair, but smaller; the first pair of plates are situated near the inner margins of the median lobes, are rather conspicuous, and have about five points, the second pair are between the median lobes and the first incision, are somewhat less conspicuous than the first and have about four points, the third pair are between the second pair of lobes and the second incisions, are of about the same size as the second pair, and also have four points; there are five deep incisions on either lateral margin, situated as follows: Between first and second pairs of lobes, between second and third pairs of lobes, a double one just laterad of the third pair of lobes and a single one a considerable distance above these. The spines are inconspicuous except the median pairs; they are situated as follows: on both dorsal and ventral margins, between median lobes, laterad of median lobes, laterad of each of the second pair of lobes, laterad of each of the third pair of lobes.

After impregnation the body of the female becomes much swollen and of a dark brown color. It also becomes much elongated and the lateral lobes of each segment are almost obliterated as the young develop (Plate VI, Fig. 17).

The Young Larva (Plate VII, Fig. 18). — The young larvæ, which are developed in the body of the female, are at birth about .4 mm. in length, about .2 mm. in width, of truncate-oval form and milk-white color. Antennæ (Plate VII, Fig. 18, *a*) .08 mm. long, 6-segmented, formula, 6, 5 (3, 1) (4, 2); several long hairs on the sixth segment, a few shorter ones on each of the outer segments. The legs (Plate VII, Fig. 18, *b*) are rather short and stout, femur very stout, tibia and tarsus slender, claw long and slightly curved, with a pair of knobbed hairs dorsally and a pair of digitules ventrally.

Female Larva, First Moult. — After the first moult the larva takes the form of the adult female and begins the construction of its scale, to the anterior part of which the larval skin is attached. The scale when complete, is of the same general appearance and color as that of the adult and about one third as long.

Female Larva, Second Moult. — At the second moult the larva does not change in form, but is considerably larger. It begins a new scale, which when completed, serves as its permanent home as described for the adult female.

Scale of the Male (Plate VII, Fig. 19). — The scale of the male consists of the first larval skin and one scale, which is of the same light brown color as that of the female. Length about 2 mm. (larval skin .4 mm.), width about .8 mm.; straight,

semi-cylindrical about the middle and ending posteriorly rather abruptly; larval skin of the same size, shape and color as that of the female.

Adult Male (Plate VII, Fig. 20). — The adult male is about 1.2 mm. in length and colored as follows: Head white, with purplish tinge; eyes dark purplish; thorax brownish; abdomen purplish; wings smoky, iridescent; legs light brown; antennæ very light, about .65 mm. in length and ten-segmented, formula, 3 (4, 5, 6) (7, 8) 9, 10, 2, 1. The wings are about as long as the entire body, very light colored and minutely haired. The legs are long and slender, slightly hairy as indicated in the figure; claw long and slender, slightly curved, with a pair of long knobbed hairs dorsally, and a pair of shorter digitules ventrally.

The Young Male Larva. — The young male larva is similar to that of the female, hence needs no description.

Male Larva, First Moult. — At the first moult the male larva still has the same form as that of the female, but during this stage it grows considerably larger than that of the female of the corresponding stage.

Pupa of Male. — After completing its external scale, the larva changes to the pupa state, remaining in the larval skin until antennæ, legs and wings show quite plainly in their development, when the larval skin is shed together with the mouth-parts, and the pupa is complete.

Finally the adult male is formed and after lying quietly in place under the scale, which has served as a case for all of the above transformations, for some time, it emerges from the anterior part of the scale, pushing off the larval skin in its exit.

Habits. — The females are usually found singly on the under side near one margin of the needles of the red fir (*Pseudotsuga taxifolia*), although I have found several on one needle and have also found them thickly massed about the base of the needles of *Abies magnifica*, from high altitudes. The males are usually found singly on a needle, though more often than with the female, several are found on the same needle. Occasionally males and females are found together.

I have found the adult female throughout the entire year, but specimens in the gravid state were found in the Stanford arboretum in January, February, March and December, 1901; near Usal, Mendocino Co., July, 1901; at Shasta Camp, Mt. Shasta, August 19, 1901, and at Dunsmuir, Siskiyou Co., August 25, 1901.

Males in the young stages were found in Mendocino Co., throughout July, 1901; at Shasta Camp, Mt. Shasta, August 19, 1901; at Dunsmuir, Siskiyou Co., August 25, 1901. A few empty scales were found at each of these places. I found the young males on trees in the Stanford arboretum in Oct. and Nov., 1901, and dissected out several perfect males Nov. 15, 1901. They were very numerous about Dec. 1, but by Dec. 24 were very scarce.

Newly born larvæ were found on the white fir (*Abies concolor*), at Shasta Camp, Aug. 19, and on the red fir (*Pseudotsuga taxifolia*), in the Stanford arboretum, Dec. 15, 1901.

At nearly all stations where studied the young we found in all stages of development. It would seem from this that there is no well-defined breeding season and that breeding goes on throughout the year, the abundant season varying with the elevation and climate.

Distribution.—The first specimens were found by the author, on the red fir (*Pseudotsuga taxifolia*), near Saratoga Summit, Sierra Moreno Range, about twenty-five miles south of Stanford University, July 6, 1900. These specimens were sent to the Division of Entomology, U. S. Dept. of Agriculture, where Mr. Pergande identified them as a *Leucaspis*, sp. Since this first date I have found them on the red fir as follows: Mountains West of Napa City, Napa Co., June 17, 1901; Cobb Mt. and hills about it, Lake Co., June 21, 1901; mts. near Blue Lakes, Lake Co., June 25, 1901; from the head of Big River, Mendocino Co., all through the Coast Range to near Mendocino City, thence northward and throughout a forest of this species about thirty miles in width, in the northeast part of Humbolt Co., in June, 1901, and near Dunsmuir, Siskiyou Co., August 25, 1901.

I have also found this scale on *Abies grandis*, near Casper and Rockport, Mendocino Co.; on *Abies concolor* near Salmon Forks, Siskiyou Co., and at Shasta Camp, Mt. Shasta; in Stanford arboretum and on some herbarium specimens of *Abies magnifica* from La Porte, Pulmas Co., and from "Trail to Sentinel Dome," Yosemite: on the Shasta fir (*Abies shastensis*), near the east side of the summit of range, west of Salmon Forks, Siskiyou Co., California.

Evidently the scale is not confined to *Pseudotsuga taxifolia* although it seems to be most abundant on that species.

Type specimens of the entomological collection of Stanford University.

Leucaspis cupressi, sp. nov.

Scale of Female (Plate VII, Fig. 21). — Length 1 mm.; larval skin very minute, light yellow; second skin light, brownish-white, nearly circular; scale transparent white, oblong; the whole forming a very convex and irregularly curved scale.

Adult Female (Plate VII, Fig. 22).— Length .8 mm., width .4 mm., egg-shaped; color transparent white; segments of body very obscure. Characters of abdominal margin as follows: a single pair of lobes, rounded, with a slight lateral notch, plainly visible, but not conspicuous; a slight incision caudo-laterad of each

lobe and a slightly larger one considerably removed cephalo-lateral from each lobe; spines, four between the lobes, one between the lobes and second incision, and two cephalo-laterad of each second incision; dorsal spinning glands grouped on each lateral margin of each one of the body segments, anterior lateral groups of last segment of twenty to thirty, posterior laterals about ten.

Young Larva (Plate VII, Fig 23). — The young larvæ, which are developed in the body of the female, are at birth about .23 mm. long, .13 mm. wide, of a broadly oval form and light yellow color; antennæ six-segmented, formula, 6, 1, 3, 2 (4, 5), a single terminal hair, one long hair near the base, a shorter one near the end and one near the middle of the sixth segment, a long hair on the first segment, and very minute hairs on each of the other segments, as indicated in the figure (Plate VII, Fig. 23, *a*); legs very stout (Plate VII, Fig. 23, *b*), tarsus stout and curved, with a pair of very long knobbed hairs about the middle, dorsally, and a long hair just below these; claws very long, stout, and slightly curved, with a pair of knobbed digitules at base. Abdominal margin plain with two very long hairs.

Male not known.

Habitat. — Discovered by the author on *Cupressus goveniana*, about six miles north of the southern line of Lake Co., on the Toll road between Calistoga and Lakeport, California, June 21, 1901. This is the only locality from which it has been obtained as yet.

Type specimens in the entomological collection of Stanford University.

Physokermes taxifoliæ, sp. nov.

In June, 1900, Mr. Edw. M. Ehrhorn and the author found on the red fir (*Pseudotsuga taxifolia*) at Stevens Creek, Santa Clara Co., California, numerous specimens of the adult and young of a *Physokermes*, which after a careful comparison with *P. insignicola* Craw., we find to be very near to that species except for the following differences, viz.: The color is uniform light, mahogany brown, while that of *insignicola* is very dark or almost black; measurements of antennæ, in microns:

P. taxifoliæ, 90, 180, 150, 60, 80, 130, formula, 2, 3, 6, 1, 5, 4.

P. insignicola, 100, 280, 150, 110, 80, 150, formula, 2, (3, 6) 4, 1, 5.

The young are essentially the same in both species.

In the summer of 1901 I found this *Physokermes* on *Pseudotsuga taxifolia*, all through the coast counties of northern California, and wherever found they were of the same color. As this color is so constant and the scale insect seems to be confined to *Pseudotsuga taxifolia*, we propose it as a new species.

Type specimens in entomological collection of Stanford University.

Physokermes concolor, sp. nov.

July 31, 1901, the author found on the white fir (*Abies concolor*), near the summit of the Salmon Mts., west of Salmon Forks, Siskiyou Co., California, three specimens of the female of a *Physokermes* and later the young were obtained from these specimens.

While the young of this species is essentially the same as that of *P. taxifoliæ* and *P. insignicola*, the adults are very much lighter in color, being very light brown or fulvous and in the live state marked with a dark line along the dorso-median groove. Antennæ in microns, 120, 150, 150, 80, 70, 200, formula, 6 (2, 3), 1, 5, 4.

NOTE.—The differences in these two species and in comparison with *P. insignicola* are very hard to describe and yet with the three species before me I feel that they should be separated.

Type specimens in the entomological collection of Stanford University.

SPECIES OF COCCIDÆ FOUND ON CONIFEROUS HOSTS IN CALIFORNIA, WITH LOCALITY.

Eriococcus araucariæ *Mask.* On *Araucaria excelsior*, Hopkins Place, Menlo Park. (Introduced.)

Phenacoccus kuwanæ, sp. nov. On *Picea breweriana*, Salmon Mts., near Salmon Forks, Siskiyou Co.

Dactylopius sequoiæ *Coleman.* On *Sequoia sempervirens*, Sierra Moreno Mts. and Coast Range as far north as Humbolt Co.

Dactylopius andersoni, sp. nov. On *Cupressus goveniana*, Lake Co. and on *Libocedrus decurrens*, Scott Valley, Siskiyou Co., and upper Sacramento region.

Dactylopius dudleyi, sp. nov. On *Cupressus macnabiana*, Clear Creek, Shasta P. O., Shasta Co.

Physokermes insignicola *Craw.* On *Pinus insignis*, Stanford grounds.

Physokermes taxifoliæ, sp. nov. On *Pseudotsuga taxifolia*, Stevens Creek, Sierra Moreno Mts., and all the Coast Range as far north as the Salmon Mts.

Physokermes concolor, sp. nov. On *Abies concolor*, Salmon Mts., west of Salmon Forks, Siskiyou Co.

Lecanium hesperidum L. On *Abies concolor*, Stanford arboretum.

Lecanium oleæ *Bern.* On *Tumion californicum*, Stanford arboretum.

Aspidiotus hederæ *Vall.* On *Sequoia sempervirens*, Sierra Moreno Mts., near Stanford University.

Aspidiotus rapax. On *Sequoia gigantea*, Stanford arboretum.

Aspidiotus abietes *Comst.* On *Pseudotsuga taxifolia*, Stanford arboretum and all through the Coast Range.

Aspidiotus californicus, sp. nov. On *Pinus lambertiana*, Sugar Pine Flat, el. 7,000 ft., Sierra Nevada Mts.; *Pinus ponderosa*, Pine Ridge, Zyanta Creek, Santa Cruz Co., Cobb Mt., Lake Co., Hoopa Ind. Res., all through the mountains in Siskiyou Co., on Mt. Shasta and in northern Shasta Co.; *Pinus sabiniana*, San Felipe Hills, Mt. Hamilton Range, el. 2,700 ft., near Cobb Mt. and Lake Port, Lake Co., Hoopa Valley, upper Sacramento R. region, Shasta Co.; *Pinus coulteri*, east side of Mt. Hamilton, el. 3,700 ft., Mt. Lewis, el. 3,600 ft.; *Pinus attenuata*, mts. west of Scott Valley, Siskiyou Co., Mt. Shasta.

Aspidiotus florenciæ, sp. nov. On *Pinus ponderosa*, Pine Ridge.

Aspidiotus coniferarum, var. **shastæ.** On *Cupressus macnabiana*, Clear Creek, Shasta Co., and on *Cupressus goveniana*, southern Lake Co.

Aspidiotus ehrhorni, sp. nov. On *Abies concolor* and *Libocedrus decurrens*, Shasta Camp, Mt. Shasta (collected by Edw. M. Ehrhorn).

Chionaspis ceruela *Targ.* On *Cupressus goveniana*, Stanford arboretum.

Mytilaspis newsteadi *Sulc.* On *Sciadopitys verticellata*, Campbell Place, near Stanford University. (Determined by Mr. T. H. Pergande and said to be the first record of this species in this country.) Probably introduced from Japan.

Chionaspis pinifolia *Fitch.* On *Pinus monticola*, near Clouds Rest Peak, Yosemite; near Salmon Forks, Siskiyou Co.; *Pinus lambertiana*, Santa Lucia Peak; Hoopa Valley Indian Reservation; Sugar Pine Flat, Sierra Nevadas, 7,000 ft.; *Pinus albicaulis*, Black Butte, Siskiyou Co., above 6,000 ft.; *Pinus torreyana*, Soledad Creek; *Pinus ponderosa*, Pine Ridge; mts. in Lake Co.; Hoopa Valley Ind. Res.; all through the mountains in Siskiyou Co.; Mt. Shasta; northern Shasta Co.; *Pinus ponderosa* var. *jeffreyi*, Glacial

Point, Yosemite; *Pinus murrayana*, dry foothills, Del Norte Mts., Del Norte Co.; *Pinus sabulata*, San Felipe Hills, Mt. Hamilton Range, el. 2,700 ft., mts. in Lake Co.; Hoopa Valley Ind. Res.; Sacramento River region, in northern Shasta Co.; *Pinus coulteri*, east side of Mt. Hamilton; near Indria; *Pinus radiata*, Stanford arboretum; *Pinus attenuata*, mts. west of Napa City, Napa Co.; mts. west of Scott Valley, Siskiyou Co.; *Pinus muricata*, near Mendocino City, Mendocino Co.; *Pseudotsuga taxifolia*, Stanford arboretum; *Abies concolor*, Stanford arboretum; *Libocedrus decurrens*, Lake Co.; Hoopa Valley Ind. Res., Scott Valley, Siskiyou Co.; upper Sacramento region; *Tumion californicum*, Stevens Creek; Blue Lakes, Lake Co.

Leucaspis kelloggi, sp. nov. On *Pseudotsuga taxifolia*, Sierra Moreno Mts.; Stanford arboretum; mts. west of Napa City, Napa Co.; near head of Big River, and Usal, Mendocino Co.; Dunsmuir, Siskiyou Co.; *Abies grandis*, hills between Mendocino and Fort Bragg, and near Rockport, Mendocino Co.; *Abies concolor*, Sentinel Dome, Yosemite; Salmon Mts., west of Salmon Forks, Siskiyou Co.; Shasta Camp, Mt. Shasta, el. 3,700 ft.; Stanford arboretum: *Abies magnifica*, by trail to Sentinel Dome, Yosemite; La Porte, Plumas Co.; *Abies shastensis*, Salmon Mts., near summit of range west of Salmon Forks, Siskiyou Co.

Leucaspis cupressi, sp. nov. On *Cupressus goveniana*, southern Lake Co., about six miles north of the county line near toll road, Calistoga to Lakeport.

HOST LIST, SHOWING DISTRIBUTION OF THE CONIFERS AND THE SPECIES OF COCCIDÆ FOUND ON EACH.

Pinus monticola DOUGL. Silver Pine.— *Chionaspis pinifolia*, Just below Clouds Rest Peak, Yosemite; near forks of Salmon River, Siskiyou Co.

Pinus lambertiana DOUGL. Sugar Pine.—*Chionaspis pinifolia*, Santa Lucia Peak; southern Lake Co.; Hoopa Valley Ind. Res.; *Aspidiotus californicus*, Sugar Pine Flat, 7,000 ft., Sierra Nevadas.

Pinus albicaulis ENGELM. White-bark Pine.— *Chionaspis pinifolia*, Black Butte, above 6,000 ft., Siskiyou Co.

Pinus torreyana PARRY. Torrey Pine.—*Chionaspis pinifolia*, Soledad Creek.

Pinus ponderosa LAWS. Bull Pine. — *Chionaspis pinifolia*, Pine Ridge ; near summit of mts., southern Lake Co. ; line and Cobb Mt., Lake Co.; Hoopa Valley Ind. Res.; near Salmon Forks and all along through the mountains in southern Siskiyou Co., Mt. Shasta, northern Shasta Co.; *Aspidiotus florenciæ*, Pine Ridge ; *Aspidiotus californicus*, Pine Ridge ; Zyanta Creek, Santa Cruz Co. ; Cobb Mt., Lake Co.; near head of Supply Creek, Hoopa Valley, Ind. Res.; Salmon Forks, all through the mountains of southern Siskiyou Co., including Mt. Shasta and in northern Shasta Co.

Pinus jeffreyi "Oreg. Com." Jeffrey Pine.— *Chionaspis pinifolia*, Glacial Point Yosemite ; near Salmon Forks, Siskiyou Co:

Pinus murrayana "Oreg. Com." Lodgepole Pine.— *Chionaspis pinifolia*, dry foothills, Del Norte Mts., Del Norte Co.

Pinus sabiniana DOUGL. Gray Pine.— *Chionaspis pinifolia*, San Felipe Hills, Mt. Hamilton Range, alt. 2,700 ft. ; near Cobb Mt., and Lakeport, Lake Co. ; Hoopa Valley ; Upper Sacramento region, Shasta Co. ; *Aspidiotus californicus*. Same localities as above.

Pinus coulteri LAMB. Coulter Pine.— *Chionaspis pinifolia*, east side of Mt. Hamilton ; near Indria ; *Aspidiotus californicus*, east side of Mt. Hamilton, alt. 3,700 ft. ; Mt. Lewis, alt. 3,600 ft.

Pinus radiata DON. Monterey Pine. *Pinus insignis* DOUGL.— *Chionaspis pinifolia*, Stanford University arboretum ; *Physokermes insignicola*, Stanford University arboretum ; *Lecanium hesperidum*, Stanford University arboretum ; *Aspidiotus hederæ*, Stanford arboretum.

Pinus attenuata LEMMON. Knobcone Pine.—*Chionaspis pinifolia*, high mts. west of Napa, Napa Co. ; mts. west of Scott Valley, Siskiyou Co. ; *Aspidiotus californicus*, Mt. Shasta ; mts., west of Scott Valley, Siskiyou Co.

Pinus muricata DON. California Swamp Pine.— *Chionaspis pinifolia*, three miles east of Mendocino City, and thence northward all along the coast, to near Rockport.

Picea breweriana WATS. Weeping Spruce.— *Phenacoccus kuwanæ*, Salmon Mts., west of Salmon Forks (near summit of range on east side), Siskiyou Co.

Pseudotsuga taxifolia (LAM.) BRITTON. Douglas Spruce.— *Chionaspis pinifolia*, Stanford arboretum; *Aspidiotus abietes*, Stanford arboretum; mts. west of Napa, Napa Co.; near head of Big River and near Usal, Mendocino Co.; near Dunsmuir, Siskiyou Co.; *Physokermes taxifolia* (Douglas Spruce or Red Fir), Stevens Creek, Santa Clara Co.; mts. west of Napa, Napa Co.; near head of Big River, Mendocino Co.; near Dunsmuir, Siskiyou Co.

Abies grandis LINDL.— Lowland Fir. *Leucaspis kelloggi*, hills between Mendocino City and Fort Bragg, and near Rockport, Mendocino Co.

Abies concolor (GORD.) Parry White Fir.—*Leucaspis kelloggi*, Sentinel Dome, Yosemite; Salmon Mts., west of Salmon Forks (near summit of range on east side), Siskiyou Co.; Shasta Camp, Sissons, alt. 3,700 ft.; Stanford arboretum; *Physokermes concolor*, Salmon Mts. (near summit of range on east side), west of Salmon Forks, Siskiyou Co.: *Chionaspis pinifolia*, Stanford arboretum; *Lecanium hesperdium*, Stanford arboretum.

Abies sastensis LEMMON. Shasta Fir.— *Leucaspis kelloggi*, Salmon Mts. (near summit of range on east side), west of Salmon Forks, Siskiyou Co.

Abies magnifica MURR. Red Fir.— *Leucaspis kelloggi*, by trail to Sentinel Dome, Yosemite (herb. specimens).

Sequoia sempervirens (LAMB.) ENDL. Redwood.—*Dactylopius sequoiæ*, Sierra Moreno Mts.; mts. west of Napa City, Napa Co.; all through the redwood belt, as far north as Humboldt Bay; *Aspidiotus hederæ*, Sierra Moreno Mts.

Sequoia washingtoniana (WINSL.) SUDWORTH. Bigtree. On some cultivated trees of this species in Stanford arboretum, I find *Aspidiotus rapax* very abundant. As this scale is quite common on other trees in the arboretum, they have probably migrated to this host.

Libocedrus decurrens TORR. Incense Cedar.— *Chionaspis pinifolia*, Lake Co.; near head of Supply Creek, Hoopa Valley Ind. Res.; Scott Valley, Siskiyou Co.; upper Sacramento.

Cupressus macrocarpa HARTW. Monterey Cypress.— *Dactylopius ryani*, Monterey Co. (Coquillett).

Cupressus goveniana GORD. Gowen Cypress.— *Dactylopius andersoni*, southern Lake Co.; *Leucaspis cupressi*, Lake Co.; *Aspidiotus coni-*

ferarum var. *shastæ*, Lake Co.; *Diaspis carueli*, Stanford arboretum.

Cupressus macnabiana MURR. Macnab Cypress.— *Dactylopius dudleyi*, near Clear Creek (four and one half miles west of Shasta P. O.), Shasta Co.; *Aspidiotus coniferarum* var. *shastæ*, same locality as above.

Tumion californicum (TORR.) GREENE. California Torreya.— *Chionaspis pinifolia*, Stevens Creek and Blue Lake, Lake Co.; *Phenacoccus*, sp., Stevens Creek (Ehrhorn); *Lecanium oleæ*, Stanford arboretum.

CULTIVATED EXOTIC SPECIES.

Pinus strobus LINN. White Pine.— *Chionaspis pinifolia*, Stanford arboretum; *Aspidiotus californicus*, Stanford arboretum.

Picea abies. Norway Spruce.— *Chionaspis pinifolia*, Cedro Place, Stanford University; *Lecanium hesperidum*, same locality as above.

Thuya orientalis.— *Diaspis carueli*, Stanford arboretum.

Juniperus communis LINN. Dwarf Juniper.—*Diaspis carueli*, Stanford arboretum.

Sciadopitys verticellata. Parasol Fir.— *Mytilaspis newsteadi*, Campbell Place, near Stanford University.

Araucaria excelsior. Norfolk Island Pine.—*Eriococcus araucariæ*, Hopkins Place, near Menlo Park.

NOTES ON ECONOMIC STATUS.

The following brief notes on the distribution, abundance and injurious effects of the coniferous Coccidæ may be of interest:

It is evident from a study of the records that *Chionaspis pinifolia* is the most cosmopolitan species, *i. e.*, is found on a greater number of species of conifers, is more generally distributed and is found at a greater range of altitude (sea level to 7,000 feet) than any other species. It occurs in such numbers, along with *Physokermes insignicola*, on the Monterey pine (*Pinus insignis*), on the Stanford Ranch, as to be very injurious to the trees; indeed these trees are slowly dying, the needles first turning yellow, finally dying and dropping off. It is very abundant on almost all species of conifers infested by them, especially where the trees are on a dry hillside or in a hot interior valley, and in several instances I thought them to be very injurious.

On Cobb, Mt. Lake Co., I found a group of yellow pines (*Pinus ponderosa*), which was evidently being killed by *Aspidiotus californicus*. A group of half a dozen trees, about 6 to 8 inches in diameter and 60 to 70 feet high, were literally covered from bottom to top with these Coccidæ; though the trees were still alive, the needles were so pale and discolored as to give the trees a very sick appearance. A few rods from these trees stood another group of three, which had evidently succumbed the year previous, as the dead needles were still hanging to the limbs. A careful inspection of the trees showed them to be covered with the same species of scale as the neighboring trees and that the injury had not been caused by other insects. A fire had gone through the forest the year before, and although it had destroyed many trees, this group had not been touched, as they stood by the roadside, thus being isolated from the main forest. Hence I think it fair to conclude that the trees were killed by the scale insects. This species, *A. californicus*, is a close second in its abundance and range of distribution in this state to *Chionaspis pinifolia*.

Macnab's cypress (*Cupressus macnabiana*) is very limited in its distribution and in number of individuals. The group at Clear Creek, Shasta Co., consists of about a dozen small trees, all of which are very badly infested with *Dactylopius dudleyi* and *Aspidiotus coniferarum* var. *shastæ*, so much so that it seems to me this small grove of a very rare species is doomed to speedy extinction.

Leucaspis kelloggi is found on all the species of firs with which I am acquainted and is widely distributed over the state. While no serious injury from this species is apparent, it is sufficiently abundant in most localities to become injurious should the conditions favor its increase.

The conifer-infesting Coccidæ are most numerous, in both numbers of individuals and species, in the hot interior valleys and on dry hillsides, at about 1,000 to 3,000 feet elevation, or what corresponds in most cases to the upper Sonoran zone, and usually on the young growth which has been left after lumbering the region, or has come up after a fire has gone through the forest. In the fog belt or the great lumber belt of the coast range there are very few species or individuals in the virgin forests, but where the region has been lumbered or a fire has gone through a few years before they are more numerous. Near the coast they are scarce, except in dry plateaus or hillsides, where somewhat protected from the cold ocean breeze.

Remedies. — The question of the destruction of these insects is one which will require much further study, and is, I believe, of sufficient importance to warrant further investigation.

In the present state of our forestry operations in California it is of course impractical to spray or fumigate the forest trees, except by individual owners in limited areas, or where it is desired to preserve some cultivated species. However, a number of species of these coccidæ harbor from one to several species of parasites, which in most cases, except where the conditions are extremely favorable for the increase of the scale insects, are very effective in keeping them in check.

The proper solution of this problem will only come with the development of a proper forestry system for our extensive forest areas in California, as well as in other states. When we have competent foresters and forest entomologists we can look to them to see that badly infested trees are destroyed and that proper parasites are introduced.

PREVIOUS RECORDS OF COCCIDÆ FOUND ON CONIFEROUS HOSTS, WITH REFERENCE BIBLIOGRAPHY.

Monophlebus hellenicus *Gennadius.* On *Pinus halepensis.* (Cockerell, Food-Plants of Scale Insects, p. 773, Proc. U. S. Nat. Mus. XIX.)

Monophlebus burmeisteri *Westw.* On *Pinus*, sp., Yokohama, Japan, and on *Ficus*, sp., China. Also on *Gardena florida*, Hongkong, China. (Maskell, Trans. N. Z. Inst., Vol. XXIX, p. 328.) Also on *Pinus*, sp., Yokohama, Japan. (Kuwana, Coccidæ of Japan, Proc. Calif. Acad. Sci., Vol. III, No. 2, p. 46.)

Icerya purchasi *Mask.* On pines and firs. (Maskell, Scale Insects of New Zealand, p. 113.) On cypress (*ibid.*, p. 112).

Eriococcus gilletti *Tinsley.* On *Juniperus virginianus*, Salida, Colorado. (Can. Ent., Vol. XXXI, 1889, p. 46.)

Eriococcus araucaria *Mask.* On Norfolk Island pine (*Araucaria*). (Maskell, Scale Insects of New Zealand, p. 113; Comstock, 2d, Cornell Report, p. 137) (as *Rhizococcus*).

Eriococcus phyllocladi *Mask.* On *Phyllocladis trichomanoides*, D. Don., New Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXIV, p. 25.)

Puto attenuata *Sign.* On *Pinus cembra.* (Signoret, Essai sur les Coch., p. 375.)

Rhizococcus totaræ *Mask.* On *Podocarpus totaræ* and on *Fagus menziesii*, near Reefton, N. Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXII, p. 142.)

Dactylopius ryani *Coq.* On *Thuya orientalis*, California. (Coquillet, West American Scientist, 1889, p. 122.) Also on *Cupressus macrocarpa* and *Araucaria excelsa*, California. (*Ibid.*)

Dactylopius aurilentus *Mask.* On *Araucaria bidwilli* Hooker and *Araucaria excelsa*, Auckland, N. Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXII, p. 152.)

Dactylopius pini *Kuwana.* On *Pinus*, sp., Kiushu, Japan, and on *Pinus pentaphylla*, Tokyo, Japan. (Kuwana, Coccidæ of Japan, Proc. Calif. Aca. Sci., Vol. III, p. 54.)

Phenacoccus minimus *Tinsley.* On *Picea pungens*, Fort Collins, Colo. (Can. Ent., Vol. XXX, p. 223.)

Ceroplastes rubens minor *Mask.* On *Pinus sinensis* and on *Pinus thunbergii*, China. (Maskell, Trans. N. Z. Inst., Vol. XXIX, p. 309.)

Pulvinaria maskelli *Oliff* var. **spinosior** *Mask.* On *Frenela* or *Callistris robusta*, South Australia. (Maskell, Trans. N. Z. Inst., Vol. XXVI, p. 78.)

Ctenochiton dacrydii *Mask.* On *Dacrydium cupressinum*, New Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXIV, p. 18.)

Physokermes insignicola *Craw.* On *Pinus insignis*, Golden Gate Park, San Francisco, Calif. (Cockerell, Can. Ent., 1895, p. 258.)

Physokermes abietes *Modeer* (*Lecanium piceæ*). (Signoret, Essai sur les Coch., p. 273.) Newstead cites it only from *Abies* (Ent. Month. Mag., 1893, p. 209). On *Abies excelsa* in Europe. (Cockerell, Food-Plants of Coccidæ, Proc. U. S. Nat. Mus., Vol. XIX, p. 773).

Physokermes coloradensis *Ckll.* On spruce, Manatou, Colorado. (Gillette and Baker, Hemiptera of Colorado, p. 126.)

Lecanium parvicorne *Ckll.* On *Pinus*, Florida, U. S. (Psyche, July, 1897, p. 90.)

Lecanium pini *King.* On *Pinus austriaca*, London, Ontario. (Can. Ent., 1901, p. 334.)

Lecanium oleæ *Bern.* On Irish juniper, cedar of Lebanon and Indian cedar, Los Angeles Co., California. (Coquillett, Bull. 26, Div. of Ent. U. S. Dept. of Agric., pp. 28–29.)

Lecanium fletcheri *Ckll.* On juniper, N. Y. (Pettit, Bull. 7, Cornell Univ. Exp. St., p. 341.)

Lecanium pallidior *Ckll.* and *King.* On *Chamæcyparis thyoides* Methuen, Mass. (Cockerell and King, Psyche, Vol. VIII, p. 349.)

Lecanium minimum pinicola. On *Pinus insignis* Dougl., Cape of Good Hope, S. Africa. (Maskell, Trans. N. Z. Inst., Vol. XXIX, p. 310.) See also Ent. Mo. Mag., 1896, p. 225.

Aspidiotus abietes *Schrank.* On pitch pine, Ithaca, N. Y. (Comstock, Agric. Report, 1880, p. 306.) (Syn. *Asp. pini.*) On under surface of hemlock leaves (*Abies canadensis*), Ithaca, N. Y. (Comstock, 2d, Cornell Rep., 57.) On pitch pine, Karner, N. Y. (Bull. N. Y. State Museum, Vol. IX, No. 46.) On *Pinus sylvestris*, Prague, Bohemia. (Cockerell, Can. Ent., 1894, p. 190.)

Aspidiotus nerii *Bouche.* On cones of arbor vitæ (*Thuya occidentalis*), California. (Coquillett, Bull. 26, Div. Ent. U. S. Dept. Agric., p. 20.)

Aspidiotus (Diaspidiotus) glanduliferus *Ckll.* On branches of *Pinus sylvestris*, Columbus, Ohio. (Cockerell, Ohio Nat., Vol. II, No. 8.)

Aspidiotus cupressi *Ckll.* On *Cupressus* (Koeble), Toluca, Mexico. (Biol. Cent. America, p. 23.)

Aspidiotus aurantii *Mask.* On *Podocarpus*, Honolulu (on trees from Japan). (Maskell, Trans. N. Z. Inst., Vol. XXVII, p. 41.) On *Podocarpus chinensis*, Yokohama, Tokyo, and Wakayamaken. (Kuwana, Coccidæ of Japan, Proc. Calif. Acad. of Sci., Vol. III, No. 2, p. 70).

Aspidiotus hederæ *Val.* On leaves of *Pinus*, Oaxaca, Mexico, Aug. 20, 1897. (Koeble, 1897, pars.) (Ckll.) On *Pinus*, Mexico. (Cockerell, Mag. Nat. Hist., Feb. 1899, p. 167.)

Aspidiotus lataniæ *Sign.* On *Abies firma.* Nishigahara, Agric. Exp. Station, Tokyo. (Kuwana, Coccidæ of Japan, Proc. Cal. Acad. of Sci., Vol. III, No. 2, p. 68.)

Aspidiotus cryptomeria *Kuwana.* On *Cryptomeria japonica*, Gifuken, Japan. (Kuwana, Coccidæ of Japan, Proc. Cal. Acad. of Sci., Vol. III, p. 69.)

Chrysomphalus dictyospermi *Morgan.* On leaves of *Pinus*, Oaxaca, Mexico, Aug. 20, 1897. (Koeble, 1897 pars.) (Ckll.)

Poliaspis pini *Mask.* On *Pinus densiflora.* (Maskell, Trans. N. Z. Inst., Vol. XXX, p. 231.)

Mytilaspis newsteadi *Sulc.* On *Pinus sylvestris*, Bohemia. (Cockerell, Food-Plants of Coccidæ, Proc. U. S. Nat. Museum, Vol. XIX, p. 773.)

Mytilaspis abietes *Sign.* On *Abies excelsa*, Europe. (Signoret, Essai sur les Coch., p. 135; Comstock, 2d, Cornell Rep., 1880, p. 121.)

Mytilaspis pallida *Green* (var.). On *Podocarpus*, sp., Honolulu, H. I. (on trees from Japan). (Maskell, Trans. N. Z. Inst., Vol. XXII, p. 46.)

Mytilaspis citricola *Pack.* On *Taxus cuspidata*, Japan. (Kuwana, Coccidæ of Japan, Proc. Cal. Acad. Sci., Vol. III, p. 81.)

Diaspis carueli *Targ.* On *Thuya occidentalis*, Washington, D. C. Also on *Juniperus communis* and *J. chinensis*, *J. oxycedens* and *J. japonica* (syn. of *chinensis*), *ibid.* Collected by Targ. Tozzetti, at Orbitello near Florence, Italy. (Signoret, Essai sur les Coch., p. 436.)

Diaspis minima *Targ.* On *Thuya occidentalis* and *Cupressus*, Europe. (Comstock, 2d, Cornell Rep., p. 96; Signoret, Essai sur les Coch., p. 438.)

Diaspis juniperi *Bouche.*— On *Juniperus communis.* (Signoret, Essai sur les Coch., p. 437.)

Chionaspis pinifolia *Comstock.* (*Aspidiotus pinifolia* Fitch). "Recorded on *Pinus strobus*, *Pinus resinosa*, *Pinus mitis*, *Pinus cembra*, *Pinus pyreniaca*, *Pinus laricis*, *Pinus sylvestris*, *Pinus austriaca* and *Pinus pumella.* The Department of Agriculture contains examples from *Pseudotsuga taxifolia* and *Abies excelsa* and I have received specimens on *Abies nigra* from Canada, and *Abies alba*, Mass."

"Received from Maine, New York, New Jersey, District of Columbia, Michigan, Iowa, Illinois, Missouri, New Mexico, Florida,

Colorado and California." (R. A. Cooley, The Coccid Genera *Chionaspis* and *Hemichionaspis*, Bull. Hatch, Exp. Station, Aug., 1899.) On pines and spruces and *Pinus monophylla*. (Comstock, 2d, Cornell Rep., 1880, p. 319.)

On firs and spruces, Colorado. (Gillette and Baker, Hemiptera of Colorado, p. 129; Signoret, Essai sur les Coch., p. —, as *Mytilaspis pinifolia*.)

Prof. Cockerell sends me specimens which he collected March 27, 1902, at Prescott, Ariz., on *Pinus*.

Chionaspis pinifolia heterophylla *Cooley*. On *Pinus heterophylla*, Florida. (R. A. Cooley, Bull. Hatch, Exp. Station, Aug., 1899.)

Leucaspis signoretii *Targ*. On *Pinus sylvestris*, France. (Signoret, Essai sur les Coch., p. 100 (144).)

Leucaspis pini *Hartig*. On *Pinus laricis*, Poir, France. (Signoret, Essai sur les Coch., p. 146.)

Leucaspis leonardii *Ckll*. sp. nov. On *Pinus picea*, Portici, Italy. (Cherm. Ital., Fasc. I, No. 19 as *L. pini*.)

Fiorinia sulcii *Newst*. (See Ent. Mo. Mag., 1894, p. 232.) "According to Mr. Sulc, the *Fiorinia sulcii* Newst., formerly confounded with *Leucaspis pini*, is a distinct species, but nevertheless a *Leucaspis* Ckll. On *Pinus*, Dordogne, France, 1901, P. Marchal (through Prof. T. D. A. Cockerell). Also on *Pinus sylvestris*, Brandenberg, Germany, Reh. (through King and Cockerell).

Leachea zealandica *Mask*. On *Podocarpus totaræ* and *Cupressus dacrydiodes*, New Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXIII, p. 27.)

Fiorinia camelliæ. On *Pinus chinensis*, Hongkong, China and on *Juniperis*, Formosa. (Maskell, Trans. N. Z. Inst., Vol. XXX, p. 232.)

Fiorinia fiorinia var. **japonica** *Kuwana*. On *Pinus chinensis*, Tokyo and on *Pinus*, sp., Shiga-ken, Japan. (Kuwana, Coccidæ of Japan, Proc. Calif. Acad. Sci., Vol. III, No. 2, p. 79.)

Poliaspis pini *Mask*. On *Pinus densiflora*, Mayanoshita, on *Pinus austriaca*, Tokyo, on *Podocarpus chinensis*, Wakayama-ken, on *Abies firma*, Tokyo, on *Torreya micefera*, Tokyo, on *Pinus thunbergii*, Tokyo, and on *Pinus*, sp., Kiushiu, Japan. (Kuwana, Coccidæ of Japan, Proc. Cal. Acad. Sci., Vol. III, No. 2, p. 82.)

Cœlostoma pilosum *Mask.* On *Podocarpus totaræ*, New Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXIII, p. 30.)

Cœlostoma compressum *Mask.* On *Podocarpus totaræ*, New Zealand. (Maskell, Trans. N. Z. Inst., Vol. XXIV, p. 46.)

Coccus hystrix *Baer.* (Signoret, Essai sur les Coch., p. 455.) *Syngenaspis parlatoria* Sulc. On *Abies*, Bohemia (Sulc). (Cockerell, Food-Plants of Coccidæ, Proc. U. S. Nat. Mus., Vol. XIX, p. 774.)

Parlatoria proteus *Mask.* On *Pinus insignis* Dougl., Botanical Gardens, Sydney, Australia. (Maskell, Trans. N. Z. Inst., Vol. XXIX, p. 300.)

Pseudophillipia quaintancei *Ckll.* On pine, Florida. (Psyche, 1897, p. 90.)

EXPLANATION OF PLATES.

PLATES V.

Fig. 1. *Phenacoccus kuwanæ*, leg of adult female.
Fig. 2. " " antenna of adult female.
Fig. 3. *Dactylopius andersoni*, leg of adult female.
Fig. 4. " " antenna of adult female.
Fig. 5. *Dactylopius dudleyi*, adult female.
Fig. 6. " " leg of adult female.
Fig. 7. " " antenna of adult female.
Fig. 8. " " larva; *a*, leg; *b*, antenna.
Fig. 9. *Aspidiotus californicus*, abdominal margin of adult female.
Fig. 10. *Aspidiotus florenciæ*, abdominal margin of adult female.

PLATE VI.

Fig. 11. *Aspidiotus coniferarum* var. *shastæ*, adult female.
Fig. 12. " " " abdominal margin of adult female.
Fig. 13. " " " larva.
Fig. 14. *Aspidiotus* (subgen. *Diaspidiotus*) *ehrhorni*, abdominal margin of adult female.
Fig. 15. *Leucaspis kelloggi*, scale of female.
Fig. 16. " " adult female; *a*, abdominal margin of same.
Fig. 17. " " adult female (pregnant).

PLATE VII.

Fig. 18. *Leucaspis kelloggi*, young larva; *a*, leg; *b*, antenna.
Fig. 19. " " scale of male.
Fig. 20. " " adult male insect; *a*, leg of same.
Fig. 21. *Leucaspis cupressi*, scale of female.
Fig. 22. " " adult female.
Fig. 23. " " young larva; *a*, antenna; *b*, leg.